COMMONWEALTH OF VIRGINIA

Information Technology Resource Management Guideline

MIDDLEWARE GUIDELINE

Department of Technology Planning

Preface

Publication Designation

COV ITRM Guideline MID2001-01.1

Subject

Middleware

Effective Date

December 7, 2001

Supersedes

No prior middleware guidelines

Scheduled DTP Review

One (1) year from effective date

Authority

Code of Virginia, § 2.2-226
(Powers and Duties of the Secretary of
Technology)

Code of Virginia, § 2.2-2651
(Powers and Duties of the Council on
Technology Services)

Code of Virginia, § 2.2-1701 (Powers and Duties
of the Department of Technology Planning)

Scope

ITRM Guidelines are advisory in nature and
contain no requirements. This guideline is
provided for the benefit of all state agencies and
institutions of higher education (hereinafter
collectively referred to as "agencies") that are
responsible for supporting certain types of
applications including for example, e-mail
services, which must communicate across the
network within an N-tier architecture. This
guideline may also be beneficial to local
government entities.

Purpose

Sharing best practices related to the functions of
middleware may aid state agencies in reducing
cost, improving management practices, and
improving services and tools for the government
and its citizens. Middleware can enhance
interagency cooperative efforts, agency to
business cooperative efforts, intra-agency n-tier
program-to-program communications, and
application functionality.

Objective

To provide agencies with guidance related to
middleware selection and use as part of overall

infrastructure development, maintenance and
administration.

General Responsibilities

In accordance with the *Code of Virginia*, the
following provisions apply:

Secretary of Technology

Responsible for:

- Directing the formulation and promulgation
  of policies, standards, specifications, and
  guidelines for information technology in the
  Commonwealth, including, but not limited
  to, those (i) required to support state and
  local government exchange, acquisition,
  storage, use, sharing, and distribution of
  geographic or base map data and related
  technologies and (ii) concerning the
  development of electronic transactions
  including the use of electronic signatures as
  provided in § 59.1-496.

- Directing the establishment of statewide
  standards for the efficient exchange of
  electronic information and technology,
  including infrastructure, between the public
  and private sectors in the Commonwealth.

Council on Technology Services (COTS)

Responsible for :

- Advising and assisting the Secretary of
  Technology in exercising the powers and
  performing the duties conferred.

Department of Technology Planning (DTP)

Responsible for:

- Assisting the Secretary of Technology in the
  development of statewide policies affecting
  technology at all levels of government, in
  the business sector, and among the general
  citizenry.

- Developing and promulgating policies,
  standards, and guidelines for managing
  information technology in the
  Commonwealth.

- Developing statewide standards for the
  efficient exchange of electronic information
  and technology, including infrastructure,

between the public and private sectors in the Commonwealth.

All State Agencies

Responsible for:

- Cooperating with the Secretary of Technology, the Department of Information Technology, and the Department of Technology Planning in the performance of their powers and duties; and

- Complying with the Department of Technology Planning's policies, standards, and guidelines for information technology resources in the Commonwealth.

Definitions

Middleware is most often software and in some cases, hardware, which may perform many integral functions in a networked environment and which may provide sets of useful tools for applications that run in a networked environment. In an N-tier environment, applications may communicate with databases, other applications, users, etc. to accomplish their work. This requires messaging between players. Middleware addresses both messaging and tools that help to ensure the ongoing reliability of both simple communications and more complex, multi-step transactions. Middleware is not one thing. Middleware tool sets are often called by names including database middleware, transaction-processing middleware, messaging middleware, remote procedure call middleware, etc. Middleware may function within a LAN environment or over the Internet. Middleware has been described as the "glue" that ties applications together. Middleware functions may be provided by operating systems (e.g., Windows 2000), separate software bundles (e.g., middleware by Candle or Software AG), databases (e.g., Oracle), or specially written programs (e.g., in XML/XSL).

Related COV ITRM Policies, Standards, and Guidelines

COV ITRM Policy 95-1, Statewide Implementation of Electronic Commerce, dated August 8, 1995 addresses the Electronic Data Interchange (EDI) standard for electronic commerce. EDI may be classified as an international standard related to middleware functions. The ITRM policy document that addresses e-commerce and EDI will be reissued as a middleware policy upon further investigation of electronic commerce trends. Electronic

commerce methods are rapidly changing to include options other than EDI.

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Background

Earlier Commonwealth ITRM policies, standards and guidelines did not specifically address middleware. The term, middleware, is relatively new in the definition of computing architectures. Separate middleware products have mushroomed in recent years along with the growth of multi-tiered applications, e-business, and multi-platform, distributed computing environments. As agencies of the Commonwealth increase the number of networked applications they support, they must also increase their attention to purposefully designing their computing architectures with respect to those "middle" functions common across their networked applications.

Middleware provides vehicles for enabling agencies to move from stovepipe application architectures to more integrated systems. Among the services and tools provided by middleware are centralized and distributed directory services and robust enterprise-wide messaging services.

This document addresses middleware best practices. The guidance provided herein is expected to benefit both individual agencies and groups of agencies working on common networked computing efforts. The guidance presented emanates from the work of the Enterprise Architecture Middleware Domain team. The team had state agency, local government, and higher education members.

Approach

This document will provide: 1) a listing of the middleware related best practices, 2) reference materials and Web sites related to the guidance provided, and 3) a general discussion of how state agencies would typically implement the practices.

Every effort will be made to ensure that guidance in this document is reviewed annually. As reviews are conducted, the review dates and recommended modifications will be added to this document.

Reviews

Revisions anticipated within the next 12 months include new developments in middleware and the movement of various IETF standards from proposed standards to draft standards to Internet standards. A full review of the COV ITRM Guideline MID2001-1.1 is anticipated one year from the release date.

Statement of ITRM Best Practices for Middleware

The following ITRM best practices address the use of common middle functions and middleware tools to increase opportunities for more cost-effective, efficient, or reliable computing across applications both within agencies and across agencies. In addition, these best practices call for coordinating efforts across agencies for the benefit of all agencies planning the acquisition of or use of middleware. These best practices may

assist an agency in providing a sound architectural foundation for conducting the future business of the Commonwealth. For a comprehensive overview of middleware architecture for the Commonwealth, please see the *Middleware Architecture Report* at: http://www.sotech.state.va.us/cots/ea/documents/Middleware Architecture - Approved.doc.

Best Practice 1.   *Planning.* Before acquiring a central middleware solution, agencies should map their present middleware sources and uses, and should develop a plan for migration to the central middleware or modifying present uses if needed. Agencies should use middleware strategies that are scalable, extensible, and maintainable.

Best Practice 2.   *Define Interfaces*. Agencies should carefully define their interfaces and business requirements.

Best Practice 3.   *XML Documentation.* As XML becomes more widely used in state and local government, the Secretary of Technology should designate a responsible agency for providing Web-based access to common tag definitions, DTDs, XML Schemas and CSSs to promote consistent use of terms and to support reuse of prior work whenever possible. Agencies using XML should participate in and monitor state and federal initiatives in their sphere for XML tag standards development.

Best Practice 4.   *XML Storage*. Agencies should only use XML for classifying data content for message interfacing and presentation. XML data should not be stored long-term.

Best Practice 5.   *XML/SOAP*. Agencies considering XML and SOAP should investigate the error detection, and auditing capabilities of their application.

Best Practice 6.   *Interfaces*. Agencies should buy interfaces, not build them.

Best Practice 7.   *Strategic Investigation.* The Commonwealth and its agencies should carefully investigate the success other agencies and states have had in the deployment of middleware products before considering a separate middleware acquisition.

Best Practice 8.   *Shared Resource.* Agencies may wish to consider whether they should acquire middleware as a shared resource across several agencies.

Best Practice 9.   *Logical Partitioning.* Agencies should use middleware (messaging) to support logical application partitioning and boundaries.

Best Practice 10.   *Open Interfaces*. Agencies should use technologies that support open interfaces, are persistent, and are non-proprietary whenever possible.

Best Practice 11.   *Efficiencies.* Asynchronous messaging provides opportunities for making efficient use of parallel processing capabilities in the network environment.

Best Practice 12.   *Single Sign-on*. Middleware can play an important role in enabling a single sign-on for all applications and services.

Best Practice 13.   *Security and Directories.* Agencies should consider implementing separate directories for internal use and external (i.e., beyond the firewall) use.

Best Practice 14. *Email.* The Message Transfer Agent (MTA) in email applications should be LDAP enabled.

Best Practice 15. *LDAP Schema Coordination.* Many universities use the EDUCAUSE/Internet2 eduPerson task force effort as a vehicle for coordinating directory standards for faculty and student access. The EDUCAUSE/Internet2 eduPerson task force has the mission of defining an LDAP object class that includes widely used person attributes in higher education. The URL for the Higher Education LDAP Schema work is: http://www.educause.edu/eduperson. The Department of Technology planning should investigate the utility and applicability of this work to government-wide person attributes.

Best Practice 16. *Adapters.* New object-oriented business applications should be portable object adapter (POA) compliant.

Best Practice 17. *Evaluation of a Superservice Product.* The Enterprise Architecture team in cooperation with the Department of Technology Planning should identify a project that could be used to evaluate a super-service middleware product. The super-service product would be used to provide necessary middleware services on a project that needs more than one middleware service. The evaluation results could be incorporated into middleware best practices.

Resources

Standards Groups

EDUCAUSE/Internet2 eduPerson task force has the mission of defining an LDAP object class (LDAP Schema) that includes widely used person attributes in higher education (http://www.educause.edu/eduperson).

IANA is the Internet Assigned Numbers Authority controls numbers and names including those related to mail extensions (e.g., image and .gif) and RFCs (e.g., RFC 2045 addresses MIME). This is a good place to glance at topics being addressed (http://www.iana.org/).

IETF or The International Engineering Task Force is the standards group that addresses messaging protocols and directories (http://www.ietf.org/).

The International Telecommunications Union or ITU-T maintains the X.500 series of publications and developer's guides (http://www.itu.org/ or http://www.itu.int/rec/recommendation.asp?type=products&lang=e&parent=T-REC-X).

Internet 2 addresses middleware including directories, authentication, and security (http://www.internet2.org/).

The Internet Mail Consortium addresses messaging. The IMC also provides an excellent explanation of Internet Drafts versus Internet standards (http://www.imc.org/mail-standards.html).

The Open Group addresses standards including X.400 messaging and X.500 directory (http://www.opengroup.org/).

World Wide Web Consortium or W3C provides XML related sources (http://www.w3c.org/).

Glossary

Council on Technology Services (COTS) - An advisory group to the Secretary of Technology that represents state and local government agencies and higher education in the Commonwealth.

Cascading Style Sheets (CSC) - An XML protocol used to control formatting of Web pages.

Document Type Definition (DTD) - An XML protocol for communicating tagging standards that will be used in an XML communication. The definition of a document type in SGML or XML consists of a set of mark-up tags and their interpretation.

Electronic Data Interchange (EDI) - EDI works by providing a collection of standard message formats and element dictionary that can be used by businesses to exchange information electronically. EDI is used for electronic commerce. EDI interchanges use some variation of the ANSI X12 standard (USA) or EDIFACT (UN sponsored global standard).

Internet Engineering Taskforce (IETF) - A standards group that works on Internet architectural issues.

N-tier – N-Tier describes the result of designing applications purposefully to function across various clients, servers and databases in a networked environment instead of on just one server or on a mainframe. For example, "two-tiered environment" might mean an environment where client applications interact with a database server application. Three-tiered environment might mean a remote Internet user's browser application interacting with a Web server application, which in turn, is interacting with a database server application. N-tiers usually references two or more tiers and may reference very complex interactions.

N-tier Architecture - A client-server architecture in which the user interface, functional process logic (the middle tier) and data storage and access are developed and maintained as independent modules, most often on separate platforms. If three-tiered, the middle tier is a single tier. If n-tiered, the middle tier is multi-tiered.

Open Group - The Open Group is a standards development and product approval consortium. The Open Group's Mission is to offer all organizations concerned with open information infrastructures a forum where we can share knowledge, integrate open initiatives, and certify approved products and processes in a manner in which they continue to trust our impartiality.

Standard Generalized Markup Language (SGML) - HTML and XML are subsets of SGML.

Simple Access Object Protocol (SOAP) - A minimal set of conventions for invoking code that uses XML over HTTP.

Structured Query language (SQL) - An industry standard language for creating, updating and, querying relational database management systems.

X.400 International Telegraph and Telephone Consultative Committee (CCITT) – An X4000 committee now known as the ITU Telecommunication Standardization Sector. It completed the first release of the X.400 message handling system standard. The standard provided for the exchange of messages in a store-and-forward manner without regard to the user's location or computer system.

X.500 - An ISO OSI Directory Service with an information model, a namespace, a functional model, an authentication framework, and a distributed operation model. X.500 directory protocol is used for communication between a Directory User Agent and a Directory System Agent. To allow heterogeneous networks to share directory information, the ITU proposed a common structure called X.500. However, its complexity and lack of seamless Internet support led to the development of Lightweight Directory Access Protocol (LDAP), which has continued to evolve under the aegis of the IETF. Despite its name, LDAP is too closely linked to X.500 to be "lightweight".

X.509 – X509 represents the standards for PKI or Public Key Infrastructure (e.g., Digital Signatures).

XSL - Extensible Stylesheet Language

XML - Extensible Markup Language

XML Schema - XML Schemas express shared vocabularies and allow machines to carry out rules made by people. They provide a means for defining the structure, content and semantics of XML documents.

Appendix A: Assignment of Uniform Alphanumeric Publication Designations for all Policies, Standards, and Guidelines

The Department of Technology Planning is responsible for assigning a uniform alphanumeric Publication Designation (PD) to all Commonwealth of Virginia (COV) Information Technology Resource Management (ITRM) Policies, Standards, and Guidelines (PSG). The PD is derived, in part, from components of the Commonwealth Enterprise Architecture (EA) known as "Infrastructure Domains." The "Infrastructure Domains" and Governance are defined in the Commonwealth EA Glossary. The Governance code is used to identify those PSG that are not uniquely related to a specific infrastructure domain, e.g. "IT Project Management" or "IT Project Oversight."

The following alpha codes will be used to identify each PSG:

Infrastructure Domains + Governance	**Code**
Governance and Transitional Processes	GOV
Platform Architecture	PLA
Database Architecture	DAT
Network Architecture	NET
Security Architecture	SEC
Systems Management Architecture	SYS
Information Architecture	INF
Application Architecture	APP
Middleware Architecture	MID

Publication Designations are constructed as follows:

COV ITRM ("Policy," "Standard," or "Guideline") XXXYYYY-ZZZ
        Where: XXX is the assigned Infrastructure Domain + Governance code;
                                YYYY is the year of initial issue; and
                                ZZZ is the sequential number assigned to link related PSG.

        Example: COV ITRM Standard GOV2000-01.1 is a standard that implements
                                COV ITRM Policy GOV2000-01.1.